# SERVICE MANUAL

# FOR

# BD RATE INFUSER I

# and

# BD RATE INFUSER II

**Re Order N° 8896**
**Rev- 0**

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# SECTION 1

## INTRODUCTION AND CAUTIONS

This manual is designed to help the biomedical engineer perform routine maintenance, basic troubleshooting, and modular repair of **BECTON DICKINSON RATE INFUSERS.** Becton-Dickinson has two Rate Infusers - Rate Infuser I and Rate Infuser II. This manual applies to both.

Before attempting any maintenance or repair functions, review this material carefully to become familiar with the unit. This will help avoid possible damage and ensure that the **RATE INFUSER** will perform dependably and accurately at all times. By accepting delivery of spare parts for the **RATE INFUSER** , the party performing the installation of said components accepts responsibility for the performance of the device and, in addition, accepts any liability associated with the device incurred at the time of the repair and in the future.

To facilitate maintenance and repair, **BECTON DICKINSON** has designed the **RATE INFUSERs** to include specific user-replaceable parts (see Section 4).

Problems and/or repairs not covered in this manual should not be attempted by the biomedical engineer but should be referred to our Technical Service Department at 1-8OO-BECTON-6, or 1-201-633-5500.

To purchase spare parts, please call your local authorized BECTON DICKINSON INFUSION SYSTEMS' dealer. See Section 4 for a description of spare parts.

## THEORY OF OPERATION - RATE INFUSER I and RATE INFUSER II

The **RATE INFUSER I** is a microprocessor controlled, battery operated, portable syringe pump designed for the continious IV admininistration of medication during surgery and for patient in transport or in pediatric units. The pump accepts syringe sizes ranging from 5 cc to 60 cc and is capable of delivery rates ranging from 0.1 ml/hr to 99.9 ml/hr.

The **RATE INFUSER II** is similar except that is accepts syringes ranging from 1cc to 60cc

The unit's **POWER ON** switch activates an automatic system check. During this self-test one beep sounds, the four indicator lights flash in sequence, and the display registers all zeros. If no syringe is present, the unit performs an additional diagnostic motor speed control check. The motor runs for approximately forty (40) seconds during this test. If a syringe is in place, the unit will not perform the motor speed control check.

The occlusion mechanism is contained within the syringe clamp and operates by depressing the syringe clamp against an internal spring. The occlusion wiper constantly monitors the displacement resulting from the pressure on the spring. If the displacement exceeds the value established in the product specification, the occlusion alarm is activated. The unit will automatically interrupt the infusion, activate audible and visual alarms, and turn both the motor and the timer off.

Both rate infusers feature many other safety alarms and checks.

Operation guides for the Rate infuser I and Rate infuser II are included at the end of this service manual. Always refer to the Operation Guides for instructions on use of the pumps.

## TABLE 1 / SYRINGE SIZES AND RATES

### RATE INFUSER I

| Syringe size (cc) | Lowest rate (ml/hr) | Highest rate (ml/hr) |
|---|---|---|
| 5 BD™ | 0.1 | 25.0 |
| 10 BD | 1.0 | 35.0 |
| 20 BD | 1.0 | 60.0 |
| 30 BD, 30 PF, 35 MJ™ | 1.0 | 78.0 |
| 60 BD or MJ | 2.0 | 99.9 |

### RATE INFUSER II

| Syringe size (cc) | Lowest rate (ml/hr) | Highest rate (ml/hr) |
|---|---|---|
| 1cc BD™ or MJ™ | 0.1 | 4.0 |
| 3cc BD or MJ | 0.1 | 10.0 |
| 5cc BD or 6cc MJ | 0.1 | 25.0 |
| 10cc BD or 12cc MJ | 1.0 | 35.0 |
| 20cc BD or MJ | 1.0 | 60.0 |
| 30cc BD or 35cc MJ | 1.0 | 78.0 |
| 60cc BD or MJ | 2.0 | 99.9 |

# NOTES

# SECTION 2

## INSPECTION PROCEDURE

The following inspection procedure permits testing of the **RATE INFUSER** without opening the unit's case. This procedure may be used for periodic inspection. It should be performed as a diagnostic procedure at the completion of every repair, and after the pump has been opened. Record all data for this section.

## EQUIPMENT REQUIRED

Stopwatch (the longest test will be approx. 1 hour. Resolution should be at least 1 second).

Pressure meter (0-50 psig minimum range, 0.1 psig resolution)

Syringes : **BECTON DICKINSON, PLASTIPAK*** 3 cc, 10 cc, 20 cc, 60 cc.

**BECTON DICKINSON** Cat. No 2804 extension set (60 inch microbore tubing set).

Three way stopcock with luer fittings.

## UNIT INITIALIZATION TEST

1 Install batteries. Do not place a syringe in the clamp.

2 Press the POWER OFF button.

3 Press POWER ON button. Observe the following sequence of events :

- Beep is activated once.
- The 4 indicator lights flash in sequence

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* Plastipak is a TM of Becton Dickinson and Co.

- The unit will run a motor self-test for approximately 40 seconds.
- Display registers all "8", displays "**BD**", ("**PF**")*, "**MJ**", "**CC**" and "**ML/HR**"
- All legends except "**ML/HR**" turn off and the upper and lower segments show all "0's".

4 Press **INFUSE** button with no syringe in place.

- Observe double beep.
- Unit does not infuse.

## SYRINGE SWITCH

1 Depress **SYRINGE** switch.

- Upper portion of **LCD** display will flash "**00**".

Depress 10's switch.

Syringe size will scroll to 60 cc BD and flash.

2 *Continue to press 10's switch and ensure that display flashes the following sequence before returning to 60 cc BD.*

| Rate Infuser I | Rate Infuser II | |
|---|---|---|
| 60 cc BD™ | 60 cc BD | 60 cc MJ |
| 30 cc BD | 30 cc BD | 35 cc MJ |
| 20 cc BD | 20 cc BD | 20 cc MJ |
| 10 cc BD | 10 cc BD | 12 cc MJ |
| 05 cc BD | 05 cc BD | 06 cc MJ |
| 30 cc PF | 03 cc BD | 03 cc MJ |
| 60 cc MJ™ | 01 cc BD | 01 cc MJ |
| 35 cc MJ | | |

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* Rate I only

3 Depress **SYRINGE** switch
Syringe size will stop flashing

## RATE SWITCH

1 Depress **RATE** switch
Lower portion of LCD display will flash.

2 Press **10's** switch.

3 Ensure that digits 0 to 9 are displayed for tens place.

4 Repeat for **1's** switch and .1's switch.

5 Set rate to 60.0 ml/hr.

6 Depress **RATE** switch.

## LOW VOLUME CHECK /VOLUME DELIVERED CHECK

1 *Place a 20 cc syringe in clamp. Set syringe plunger to 5 cc ± .2 cc.* Move pusher block down onto syringe flange.

2 With syringe size set to "20 cc BD" and rate to "60.0 ml/hr", press **INFUSE** switch.

- Press and hold **VOL DEL** switch. "ml/hr" will change to "ml". LCD will display milliliters delivered. Release **VOL DEL** switch
- **Low Volume LED** will begin to flash within 1 to 5 minutes.
- After the **Low Volume LED** begins to flash, a double beep will be heard every 5 seconds.
- *Press the* **SYRINGE** *switch. Beeping will stop.*
- Press **STOP** infusion switch. Motor will stop and infusion LED will turn off.

3 Moving the pusher up to top position will turn off LOW VOLUME LED.

## OCCLUSION TEST

**1** Turn on pressure meter.

**2** Place an unused 5 cc syringe filled with 5.0 cc ± .2 cc of water into position in the clamp block and pusher block. *Do not push down on the syringe using pusher block; a loose mounting is desired.*

☐ **NOTE : syringes with abnormally high friction should not be used.**

**3** Depress **SYRINGE**

**4** Set syringe size to **5 cc BD**

**5** Depress **SYRINGE**

**6** Depress **RATE** switch.

**7** Set rate to **25.0 ml/hr.**

**8** Depress **RATE** switch

**9** Connect the pressure meter to the syringe through a three-way valve and a BD extension set (NO. 2804)(See FIG. 2).

**10** With the system vented, advance the pusher toward the clamp until two or three drops of water are released (all air is out of the system) and zero relative pressure is applied to the pressure meter. Close the vent valve.

5 cc

**11** Depress **INFUSE** switch. 25 mL/hr 9.9 - 27.0 psis

**12** Blinking **ATTENTION LED**, and "**Occ**" will display, the alarm beeps and the unit shuts down automatically before 27.0 PSIG. Minimum trigger pressure should be 9.9 PSIG. Record pressure reading and results.

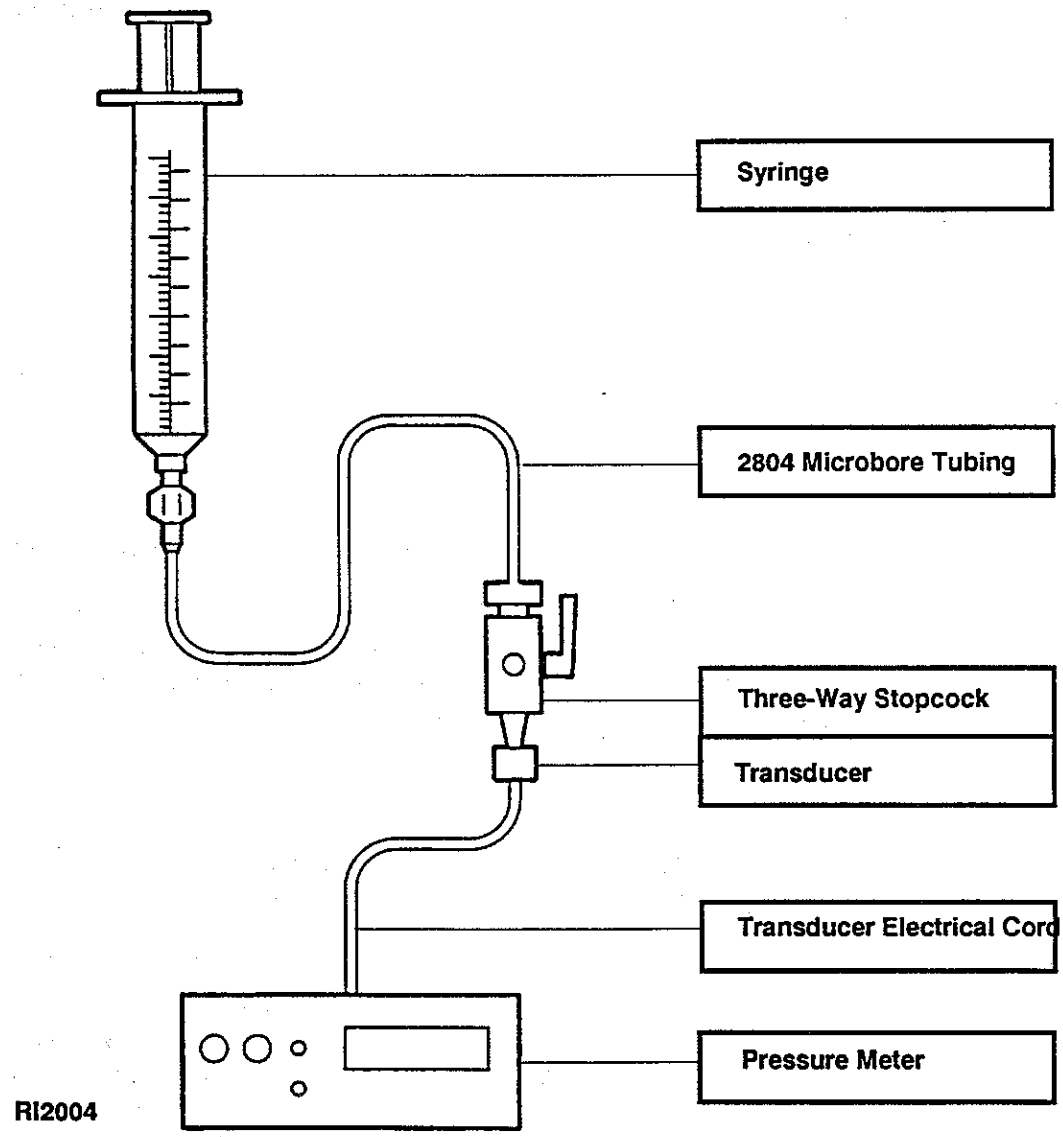
**13** Depress **STOP INFUSION.** Alarm will stop and **ATTENTION LED** will stop flashing.

**14** Repeat steps 3 through 12 using a 60 cc syringe filled with 60 cc ± 0.5 ml of water. Set syringe size to "60 cc BD" and rate to "99.0 ml/hr". The occlusion alarms (blinking **ATTENTION LED,** multiple alarm beeps, and unit shut down) should be activated before the pressure reaches 12.0 PSIG. Minimum pressure should be 5.5 PSIG. Record pressure reading and results.

**15** Depress **POWER OFF.** 60 cc 5.5 - 12.0 PSIG

Aff 99 mL/hr

**Figure 2 :Occlusion TEST**



## ACCURACY TEST

### Method "A" weight test

1. Insert a filled 60 cc syringe into the pump. Attach a tubing set.
2. Prime the unit.
3. Set the **RATE** for 99.9 ml/hour
4. Run the discharge of the tubing set into a container on a balance.
5. Tare (zero) the balance.
6. Run the pump for 30 minutes ± 5 seconds.
7. Record the weight on the balance.
8. Volume delivered should be between 47.45 and 51.45 gms.
9. Repeat for a 5 cc syringe set at 0.1 ml/hr. Run for 10 hours ± 5 seconds. Volume delivered should be between 0.95 and 1.03 gms.

☐ **NOTE 1 : to minimize evaporation, place a thin film of light oil in the container before starting tests.**
**NOTE 2 : Syringe inaccuracies may affect the results utilizing this method. Method "B" is utilized by BECTON DICKINSON in routine testing.**

## ACCURACY TEST

### Method "B" linear displacement

1 Mount RATE INFUSER in a gage system which can measure the linear travel of the pusher. Assure that the force against the pusher is constant and less than 0.5 lbs. Measure the motion on the part of the pusher closest to the pump housings

2 Depress **POWER ON**

3 Place a 5 cc syringe in syringe clamp. Push syringe flange down to bottom of travel.

4 Depress and hold **PRIME** switch to prime the unit.

5 Release switch when gage moves forward at least 0.30 inch.

6 Set syringe size to "5 cc BD" and rate to "25.0 ml/hr".

7 Zero dial or digital gage and record starting position.

8 Simultaneously press **INFUSE** and start the stopwatch. After 5 min. ± 2 seconds press **STOP** Infuse. Record ending position. Press volume delivered switch. Record reading.

9 Subtract ending position from starting position and record displacement.

10 Displacement should be between .691 and .747 inches. Volume delivered should be 2.0 ml ± 0.1 ml.

11 Depress **POWER OFF.**

12 Repeat test for 5 cc BD syringe run at 0.1 ml/hr for 4 hours ± 5 seconds. Displacement should be between 0.1328 and 0.1434 inches. Volume delivered should display 0.4 ± 0.1 ml.

## DATA SHEET FOR TESTING BECTON DICKINSION RATE INFUSER

**Reference: BD RATE INFUSER repair and diagnostics manual**

| |
|---|
| Serial number |
| Tested by |
| Dept./Location |
| Date |

| | TEST | PASS | FAIL |
|---|---|---|---|
| | Unit initialization | | |
| | Low volume | | |
| | Occlusion 5 cc.....psi | | |
| | Occlusion 60 cc.....psi | | |
| | High speed accuracy/weight test | | |
| | Low speed accuracy/weight test | | |

**Comments**

# NOTES

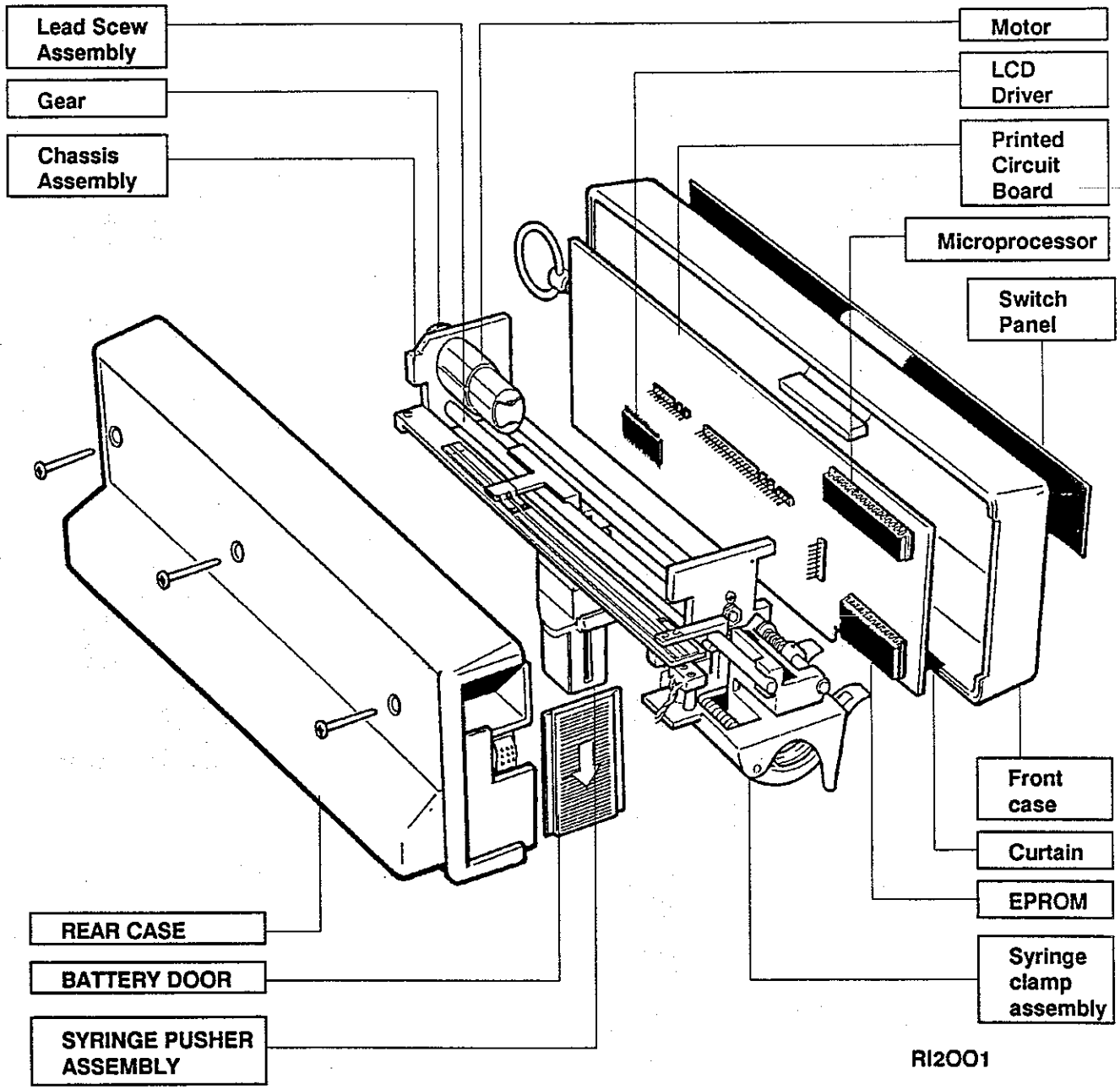
# NOTES

# SECTION 3

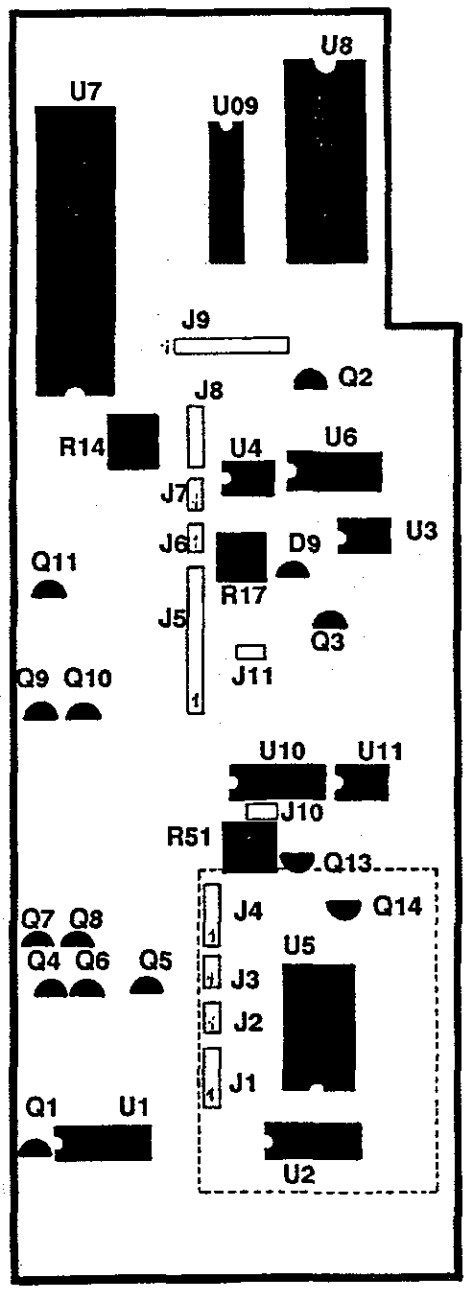
## TROUBLESHOOTING

This section provides detailed information regarding the mechanical and electrical configuration of the RATE INFUSER . The troubleshooting guide on the following page is designed to aid the bioengineer in pinpointing problems and their sources. Once the problem has been identified, the Assembly Replacement section of this manual (which follows) provides information on ordering and procedures for replacement and repair.

## Figure 2: Exploded view



## Figure 3: PC Board




PCBOARD

| Connector | Pin | Control | Wire color |
|---|---|---|---|
| J01 | | TACHOMETER | |
| | 1 | + Led optical switch | Black |
| | 2 | V Tach | White |
| | 3 | Emitter optical switch | Red |
| | 4 | Ground | Green |
| J02 | | POWER | |
| | 1 | + Battery | Red |
| | 2 | - Battery | Black |
| J03 | | MOTOR | |
| | 1 | + Motor | Red |
| | 2 | -Motor | Black/Red |
| J04 | | RATE SWITCH PANEL | |
| | 1 | Common (U7 P1-4) | |
| | 2 | .1 | |
| | 3 | 1 | |
| | 4 | 10 | |
| J05 | | MAIN SWITCH PANEL | |
| | 1 | Common (U7P1-0) | |
| | 2 | Infuse | |
| | 3 | Syringe size | |
| | 4 | Vol. Del. | |
| | 5 | Common (U7P1-2) | |
| | 6 | Stop infuse | |
| | 7 | Rate | |
| | 8 | Power on | |
| | 9 | Power off | |
| | 10 | VDD | |
| J06 | | BUZZER | |
| | 1 | + Buzzer | Orange |
| | 2 | - Buzzer | White |
| J07 | | SYRINGE PRESENCE | |
| | 1 | Common (U7P1-2) | Blue |
| | 2 | Syringe Presence | Red |
| J08 | | POTENTIOMETER STRIP | |
| | 1 | V Ref. (U6-9) | Green |
| | 2 | *Top wiper* | *Yellow* |
| | 3 | Button wiper | Orange |
| | 4 | Botton | Brown |
| J09 | | JO9/J10/J11 TEST POINTS | |
| | 1 | JO8-1 | |
| | 2 | U4-5 | |
| | 3 | | |
| | 4 | GND | |
| | 5 | VDD3 | |
| | 6 | U4-1 | |
| | 7 | VDD2 | |
| | 8 | U4-7 | |
| J10 | | | |
| | 1 | Ground | |
| | 2 | U11-1 | |
| J11 | | | |
| | 1 | Ground | |
| | 2 | U10.4 | |

## Figure 4: Electrical Schematic

An electrical schematic has been enclosed seperately with this binder.

## GENERAL TROUBLESHOOTING GUIDE

| PROBLEM | POSSIBLE CAUSES |
|---|---|
| **Power on switch is pressed, but nothing happens** | Check batteries<br>Check membrane switch<br>Check membrane switch is in correct position on PC board |
| **LCD indicators light, but tones do not sound** | Check buzzer<br>Check voltage level at buzzer connector<br>Check transistor |
| **Not all LCD indicators light** | LCD damaged, LCD driver or LCD require replacement |
| **One or more LED indicators do not function** | Check LED<br>Check LED driver |
| **Displays are erratic** | Check placement and seating of EPROM.<br>Check seating of the microprocessor.<br>LCD damaged or poor contact at the connector |
| **No tone is sounded when Infuse button is pressed** | Check membrane switch, buzzer |
| **Multiple tones sound when infuse button is pressed** | Check syringe placement<br>Check syringe clamp switch<br>Check wiring from clamp switch |

| PROBLEM | POSSIBLE CAUSES |
|---|---|
| **Attention alarm sounds within a few seconds of starting an infusion** | Check syringe for presence of occlusion; Check occlusion circuit and wiper; Check plunger driver wiper and contact with potentiometer strip; Adjust clamp assembly. |
| **Infusion starts and functions normally but attention alarm sounds and all displays flash, after approx. 15 minutes** | Indicates that mechanical drive is not functioning properly. Check motor and drive train; Check plunger driver and its engagement with drive train. |

# NOTES

# SECTION 4

## COMPONENTS AND ASSEMBLY REPLACEMENT

In order to replace any component or assembly (except for the instruction label) the unit must be opened. The batteries should be removed prior to opening the pump case. It is strongly recommended that the Alignment Test Procedure and the Occlusion Adjustment Procedure are performed on every unit that is opened. In addition, all the test procedures (Section 5) , should be performed on every unit after it has been opened.

☐ **NOTE : It is very important to avoid pinching any wires between the studs or case halves when closing the unit.**

## SPARE PARTS LISTING

| **Descripion** | **Rate *infuser* I** | **Rate Infuser II** |
|---|---|---|
| | Catalog N° | Catalog N° |
| Front case assembly | 8880 | 8833 |
| Pusher block assembly | 8851 | 8837 |
| LCD display driver | 8882 | 8882 |
| Curtains (2) | 8853 | 8853 |
| Rear case assembly | 8884 | 8884 |
| Chassis assembly with motor, encoder gear, and optical switch | 8885 | 8838 |
| Motor with gear | 8886 | 8886 |
| PC board - revision 3 with LCD | 8887 | 8887 |
| EPROM | 8888 (rev. 5) | 8834 (rev. 1) |
| Optical switch | 8889 | 8889 |

| Description | Rate Infuser I | Rate Infuser II |
|---|---|---|
| Encoder gear assembly | 8890 | 8890 |
| Microprocessor | 8891 | 8891 |
| Wired battery terminals | 8863 | 8863 |
| Battery door | 8892 | 8892 |
| Split ring with retainer | 8865 | 8865 |
| Rear instruction label | 8893 (rev. 1) | 8835 (rev. 0) |
| Clamp block assembly | 8894 | 8836 |
| Buzzer | 8867 | 8867 |
| Crystal for PC board | 8872 | 8872 |
| Diagnostic and repair manual (this manual) | 8896 | 8896 |
| LCD display | 8881 | 8881 |

See the following pages for information on how to order the correct parts for the different versions of the RATE INFUSER.

## HOW TO ORDER

| | DESCRIPTION | REQUIRED INFORMATION |
|---|---|---|
| 8833 | **Front case assembly (Rate Infuser II Only)** | Comes with curtains, battery door, screws. Does not come with instruction label |
| 8834 | **EPROM- Revision 1 (Rate Infuser II Only)** | Does not include instruction label |
| 8835 | **Rear Instruction Label- Revision 0 (Rate Infuser II Only)** | |
| 8836 | **Clamp block assembly) (Rate Infuser II Only)** | Does not include instruction label. |
| 8837 | **Pusher block assembly (Rate Infuser II Only)** | Does not come with instruction label |
| 8838 | **Chassis assembly with motor, encoder gear, and optical switch (Rate Infuser II Only)** | Does not come with instruction label |
| 8851 | **Pusher block assembly (Rate Infuser I Only)** | Does not come with instruction label |

| DESCRIPTION | | REQUIRED INFORMATION |
|---|---|---|
| **8853** | **Curtains (2)** | Does not come with instruction label |
| **8863** | **Wired battery terminals** | Does not include instruction label |
| **8865** | **Split ring with Retainer** | Does not include instruction label. |
| **8867** | **Buzzer** | Does not include instruction label |

| | DESCRIPTION | REQUIRED INFORMATION |
|---|---|---|
| 8880 | **Front case assembly (Rate Infuser I Only)** | Comes with curtains, battery door, screws. Does not come with instruction label. |
| 8881 | **LCD** | Does not come with instruction label. |
| 8882 | **LCD display driver** | Does not come with instruction label |
| 8884 | **Rear case assembly** | Comes with screws. Does not come with instruction label |
| 8885 | **Chassis assembly with motor, encoder gear, and optical switch (Rate Infuser I Only)** | Does not include instruction label |
| 8886 | **Motor with encoder gear** | Comes with motor mounting screw for gear. Does not include instruction label. |
| 8887 | **PC board - revision 3** | |
| 8888 | **EPROM - Revision 5 (Rate Infuser I Only)** | Does not include instruction label. |

| | DESCRIPTION | REQUIRED INFORMATION |
|---|---|---|
| 8889 | **Optical switch** | Does not include instruction label |
| 8890 | **Encoder gear assembly** | Does not include instruction label. |
| 8891 | **Microprocessor** | Does not include instruction label. |
| 8892 | **Battery door** | Includes copper contact strip.Does not include instruction label. |
| 8893 | **Rear instruction label revision 1 (Rate Infuser I Only)** | Replace all previous revisions. |
| 8894 | **Clamp block assembly) (Rate Infuser I Only)** | Does not include instruction label. Comes with separate wire and wiper. |
| 8895 | **Crystal for PC board** | Does not include instruction label |

☐ **TO ORDER SPARE PARTS FOR YOUR RATE INFUSER:**
**Call your local authorized BECTON DICKINSON INFUSION SYSTEMS dealer.**

☐ **For technical information regarding spare parts and repair, call BECTON DICKINSON INFUSION SYSTEMS TECHNICAL Service at 1-800-232-8666 or 1-201-633-5500**

## FRONT CASE ASSEMBLY : CATALOG N° 8880 (Rate Infuser I Only)

### Materials

1 Front case assembly
2 Curtains
1 Battery door with positive battery terminal
3 Case screws

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector.

**5** Replace the curtain on the back case and set the back case aside.

**6** Remove the chassis by disconnecting the motor, the switch panel connectors , the clamp connectors , optical switch connector,and the resistor strip connector. Set the chassis aside.

**7** Unscrew the 3 screws that hold the PC board in place and set the PC board aside. Discard the damaged front case.

**8** Attach the curtain to the new front case.

**9** Reinstall the PC board into the front case.

**10** Reinstall the chassis.

**11** Reconnect the motor connector, the switch panel connector, the clamp connector, the optical switch connector, and the resistor strip connector .

**12** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**13** Reconnect the buzzer connector and the power connector .

**14** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : when reattaching the back case use the three screws provided and take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**15** Test in accordance with inspection procedure in Section 2.

**16** Attach a new instruction label* and replace batteries.

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* Order separately

## Split ring and retainer : Catalog N° 8865

### Materials

1 Split ring with ring retainer

### Procedure

1 Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2 With the pump lying on its front face, remove the three back case screws.

3 Remove the back case. Remove any broken pieces of the ring retainer from inside the pump.

4 Place the ring retainer between the two case halves.

5 Attach the back case while holding the battery door in its channel for positionning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

6 Test in accordance with inspection procedure in Section 2.

7 Attach a new instruction label* and replace batteries.

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* Order separately

## Curtains : Catalog N° 8853

### Materials

2 Curtains

### Procedure

1 Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2 Remove the three back case screws.

3 With the pump lying on its front face, remove the back case.

4 Replace the curtain on the back case and set the back case aside.

5 Replace the curtain on the front case.

6 Attach the case halves while holding the battery door in its channel for positionning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

7 Test in accordance with inspection procedure in Section 2.

8 Attach a new instruction label* and replace batteries.

## Rear case assembly : Catalog N° 8884

### Materials

1 Rear case assembly
2 Curtains
3 N° 6 Case screws

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove and discard the damaged back case.

**4** Replace the curtain on the new back case and on the front case.

**5** Connect the buzzer connector and power connector to the PC board.

**6** Attach the case halves while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**7** Test in accordance with inspection procedure in Section 2.

**8** Attach a new instruction label* and replace batteries.

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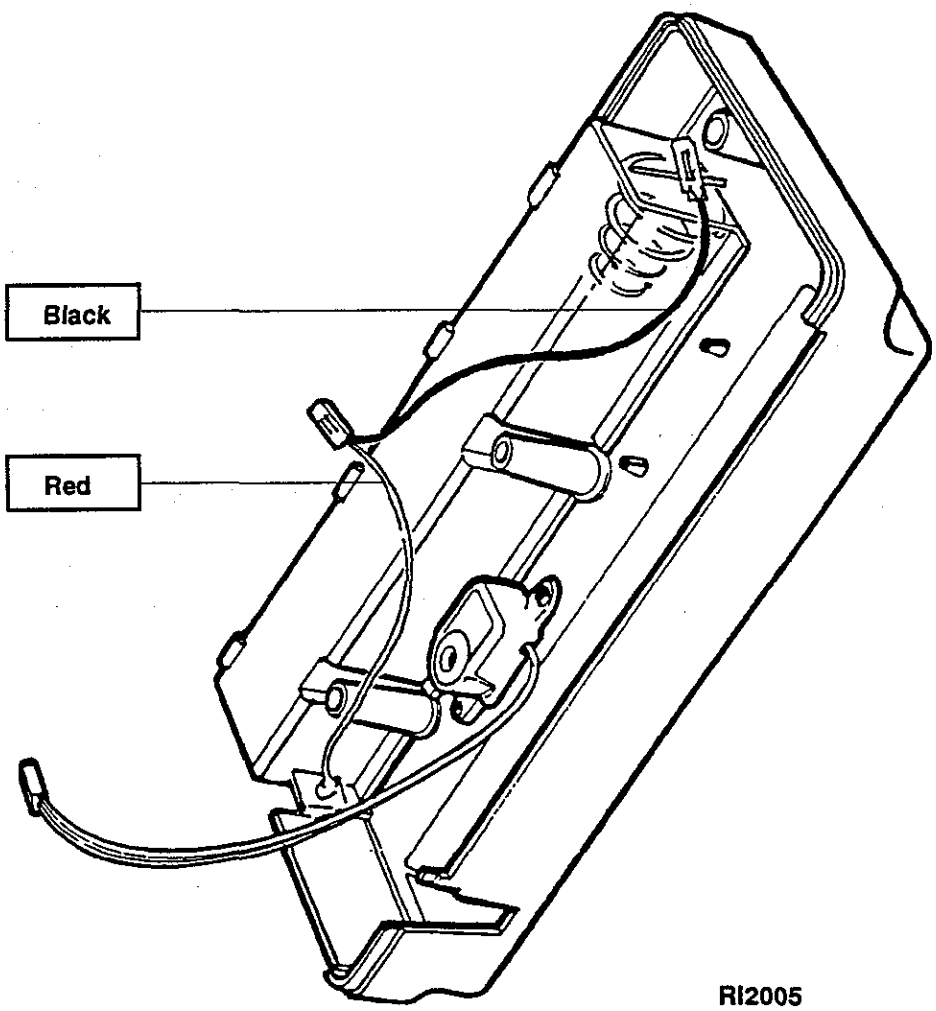
* Order separately

**Fig 5:Rear Case**



## Battery door : Catalog N° 8892

### Materials

1 Battery door with positive battery terminal

### Procedure

1 Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2 With the pump lying on its front face, remove the three back case screws.

3 Remove the back case.

4 Attach the case halves while holding the new battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

5 Test in accordance with inspection procedure in Section 2.

6 Attach the new instruction label* and replace batteries.

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* Order separately

## Wired battery terminal : Catalog N° 8863

### Materials

*1 Wired battery terminal*

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Remove the damaged battery terminal and discard.

**6** If necessary, trim the back case so that there is clearance between the positive end of the battery terminal and the back case. Do not crimp the terminal's metal contact.

**7** Slide the positive end of the battery terminal onto its mounting location of the back case. Do not slide the end clip up and over the shoulder at the far side of the mounting as this will cause interference between the two case halves.

**8** Pinch the metal contact on the negative end of the battery terminal and slide it onto the post portion of the battery compartment spring.

**9** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**10** Reconnect the buzzer connector and the power connector .

**11** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**12** Test in accordance with inspection procedure in Section 2.

**13** Attach a new instruction label* and replace batteries.

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* Order separately

## Instruction label revision 0: Catalog N° 8893 (Rate infuser II Only)

### Materials

1 Instruction label

### Procedure

1. Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2. Attach the new instruction label*.

---

* Order separately

## PC board revision 3 : Catalog N° 8887

### Materials

1 PC board

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Remove the chassis by disconnecting the motor connector , the switch panels connectors , the optical switch connector, the clamp connectors , and the resistor strip connector . Set the chassis aside.

**6** Unscrew the 3 screws that hold the PC board in place and set the front case aside.

**7** Remove the EPROM from the damaged PC board and install it in a new PC board. Do not bend the EPROM's pins. Check the EPROM orientation.

**8** Discard the damaged PC board.

**9** Install the new PC board into the front case. Do not forget to use insulating washers under the heads of the screws.

**10** Reinstall the chassis.

**11** Reconnect the motor connector , the switch panels connectors , the clamp connector ,the optical switch connector , and the resistor strip connector .

**12** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**13** Reconnect the buzzer connector and the power connector .

**14** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION: When reattaching the back case, take care not to bend or crimp the switch panel ribbons cables or any other wires.**

**15** Test in accordance with inspection procedure in section 2.

**16** Attach a new instruction label* and replace batteries.

---

* Order separately

## EPROM revision 5 : Catalog N° 8888 (Rate Infuser I Only)

### Materials

1 Programmed EPROM

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Remove the chassis by disconnecting the motor connector, the switch panels connectors, the optical switch connector, the clamp connector, and the resistor strip connector. Set the chassis aside.

**6** Pry up the damaged EPROM and discard.

**7** Install the new EPROM making sure the orientation is correct (note the notch on the EPROM and the orientation indicator marking on the PC board). Do not bend the EPROM's pins.

**8** Reinstall the chassis.

**9** Reconnect the motor connector, the switch panels connectors, the clamp connector, the optical switch connector, and the resistor strip connector .

**10** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**11** Reconnect the buzzer connector and the power connector .

**12** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**13** Test in accordance with inspection procedure in section 2.

**14** Attach a new instruction label* and replace batteries.

---

* *Order separately*

## Microprocessor : Catalog N° 8891

### Materials

1 *Microprocessor*

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Pry up the damaged microprocessor and discard.

**6** Install the new microprocessor, making sure the orientation is correct (note the notch on the microprocessor and the orientation indicator making on the PC board). Do not bend the microprocessor's pins.

**7** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**8** Reconnect the buzzer connector and the power connector .

**9** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**10** Test in accordance with inspection procedure in Section 2

**11** Attach a new instruction label* and replace batteries.

---

* Order separately

## LCD: Catalog N° 8881

### Materials

1 LCD display

### Procedure

1. Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2. With the pump lying on its front face, remove the three back case screws.

3. Remove the back case.

4. Remove the buzzer connector and the power connector .

5. Remove the chassis by disconnecting the motor connector, the switch panels connectors, the optical switch connector, the clamp connector, and the resistor strip connector . Set the chassis aside.

6. Unscrew the 3 screws that hold the PC board in place and set the front case aside

7. Unsolder the damaged LCD out of its socket and discard.

8. Install the new LCD being carreful not to heat up the PC board.

9. Reinstall the PC board. Do not forget the insulating washers.

10. Reinstall the chassis.

11. Reconnect the motor connector , the switch panels connectors , the clamp connector , the optical switch connector and the resistor strip connector .

12. Proceed to Section 5 for alignment and occlusion adjustment test procedures.

13. Reconnect the buzzer connector and the power connector .

14. Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables any other wires.**

**15** Test in accordance with inspection procedures in Section 2.

**16** Attach a new instruction label* and replace batteries.

---

* Order separately

## LCD display driver : Catalog N° 8882

### Materials

1 LCD display driver

### Procedure

1 Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2 With the pump lying on its front face, remove the three back case screws.

3 Remove the back case.

4 Remove the buzzer connector and the power connector .

5 Remove the chassis by disconnecting the motor connector, the switch panels connectors, the optical switch connector, the clamp connectors, and the resistor strip connector . Set the chassis aside.

6 Unscrew the 3 screws that hold the PC board in place and set the front case aside.

7 Desolder the LCD driver straight back out of its socket and set it aside.

8 Install the new display driver, making sure the orientation is correct (note the notch on the chip and the orientation indicator marking on the PC board). Take care not to solder adjacent legs or pads together.

9 Clean the PC board. Install the new LCD driver.

10 Reinstall the PC board into the front case. Do not forget the insulating washers

11 Reinstall the chassis.

12 Reconnect the motor connector , the switch panels connectors , the optical switch connectors , the clamp connector , and the resistor strip connector .

13 Proceed to section 5 for alignment and occlusion adjustment test procedures.

14 Reconnect the buzzer connector and the power connector .

**15** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch pannel ribbon cables or any other wires.**

**16** Test in accordance with inspection procedure in Section 2.

**17** Attach a new instruction label* and replace batteries.

* Order separately

## Crystal: Catalog N° 8872

### Materials

1 Quartz crystal

### Procedure

1. Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2. With the pump lying on its front face, remove the three back case screws.

3. Remove the back case.

4. Remove the buzzer connector and the power connector .

5. Remove the chassis by disconnecting the motor connector, the switchpanels connectors, the optical switch connector, the clamp connectors, and the resistor strip connector . Set the chassis aside.

6. Unscrew the 3 screws that hold the PC board in place and set the front case aside.

7. Remove the damaged crystal and discard. Clean all contact holes by desoldering.

8. Install the new crystal with the foam towards the PC Board and the body of the crystal aligned within the area marked on the PC board. The crystal should lay flat with the terminals facing the inside of the PC board and the support wire facing the outside of the PC board. Solder in place.

9. Reinstall the PC board into the front case. Do not forget the insulating washers.

10. Reinstall the chassis.

11. Reconnect the motor connector , the switch panels connectors ,the optical switch connector , the clamp connector , and the resistor strip connector .

12. Proceed to section 5 for alignment and occlusion adjustment test procedures.

13. Reconnect the buzzer connector and the power connector .

14. Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

**15** Test in accordance with inspection procedure in Section 2.

**16** Attach a new instruction label* and replace batteries.

* Order separately

## Buzzer : Catalog N° 8867

### Materials

1 Buzzer

### Procedure

1. Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2. With the pump lying on its front face, remove the three back case screws.

3. Remove the back case.

4. Remove the buzzer connector and the power connector .

5. Pry up the old buzzer and discard.

6. Install the new buzzer in the alternate mounting located on the back case. Make sure orientation of buzzer allows wires to be connected to PC board properly. Use a flat-tipped soldering tool or equivalent to slightly melt the mounting posts and secure the buzzer.

7. Reconnect the buzzer connector and the power connector .

8. Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

9. Test in accordance with inspection procedure in Section 2.

10. Attach a new instruction label* and replace batteries.

* Order separately

## Chassis assembly with motor : Catalog N° 8885 (Rate Infuser II only)

### Materials

Chassis assembly with motor, encoder gear, and optical switch.

### Procedure

1 Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

2 With the pump lying on its front face, remove the three back case screws.

3 Remove the back case.

4 Remove the buzzer connector and the power connector .

5 Remove the damaged chassis and motor by disconnecting the motor connector, the switch panels connectors, the clamp connector, the optical switch connector, and the resistor strip connector. Set the chassis aside .

6 Position the clamp on the new chassis so that it is flush with the chassis end bracket and tighten the set screw located on the collar. (See figure 8)

☐ **CAUTION : Do not compress the spring when tightening the set screw; however, the spring should not lie loose.**

7 Reinstall the chassis.

8 Reconnect the motor connector , the switch panels connectors , the clamp connector , the optical switch connector , and the resistor strip connector .

9 The Alignment and Occlusion Adjustment test procedures should be conducted at this point. See Section 5.

10 Reconnect the buzzer connector and the power connector.

11 Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires**

**12** Test in accordance with inspection procedure in Section 2.

**13** Attach a new instruction label* and replace batteries.

---

* Order separately

## Motor with gear : Catalog N° 8886

### Materials

1 Motor gear and set screw
1 Motor
3 Motor screws

### Procedure

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Remove the chassis by disconnecting the motor connector , the switch panels connectors , the clamp connector, the optical switch connector , and the resistor strip connector. Set the chassis aside.

**6** Remove the old motor gear and discard.

**7** Remove the three motor screws and discard the damaged motor.

**8** Install the new motor gear. Place a drop of thread locking compound on the set screw. Slide the motor gear onto the shaft so that the set screw lines up with the flat on the shaft and the gear is aligned with its mating gear. Tighten the set screw.

**9** Reinstall the chassis.

**10** Reconnect the motor connector , the switch panels connectors , the clamp connector , the optical switch connector , and the resistor strip connector .

**11** Proceed to section 5 for alignment and occlusion adjustment test procedures.

**12** Reconnect the buzzer connector and the power connector .

**13** Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION: When reattaching the back case, take care not to bend or crimp the switch panel ribbons cables or any other wires.**

**14** Test in accordance with inspection procedure in Section 2

**15** Attach a new instruction label* and replace batteries.

---

* Order separately

## Clamp block : Catalog N° 8894 (Rate Infuser I Only)

### Materials

1 Clamp block assembly
1 Clamp block wiper with wire

### Procedure ( See Figure 6 for additional information ).

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** Remove the back case.

**4** Remove the buzzer connector and the power connector .

**5** Remove the chassis by disconnecting the motor connector, the switch panels connectors , the optical switch connector, the clamp connector, and the resistor strip connector. Set the chassis aside.

**6** Loosen the set screw on the clamp collar.

**7** Remove the collar, spring, and washer, along with the clamp. Discard the damaged clamp.

**8** Remove any grease remaining on the clamp end of the chassis rods.

**9** Check the bottom rod for burrs by sliding the collar along the rod. Very carefuly remove any burrs using a flat file. Clean and lightly relubricate the rods after filing.

**10** Slide the new clamp onto the rods. The clamp should slide on easily. Slide on the washer, the spring, and the collar (in that order). See figure 8.

**11** *Position the clamp so that it is flush with the chassis end bracket* and tighten the set screw located on the collar. Locate collar to remove all spring looseness.

☐ **CAUTION : Do not compress the spring when tightening the set screw. Compressing the spring will affect the occlusion pressure readings.**

12 Attach the wiper to the clamp by melting the plastic nibs located on the clamp. A flat-tipped soldering iron on a low setting is recommended. Care should be taken so as not to melt these nibs completely.

13 Reinstall the chassis.

14 Reconnect the motor connector , the switch panels connectors , the clamp connector , the wiper wire, the optical switch connector, and the resistor strip connector .

15 The Alignment Test Procedure should be conducted at this point. See Section 5 .

16 Reconnect the buzzer connector and the power connector.

17 Attach the back case while holding the battery door in its channel for positioning.

☐ **CAUTION : When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

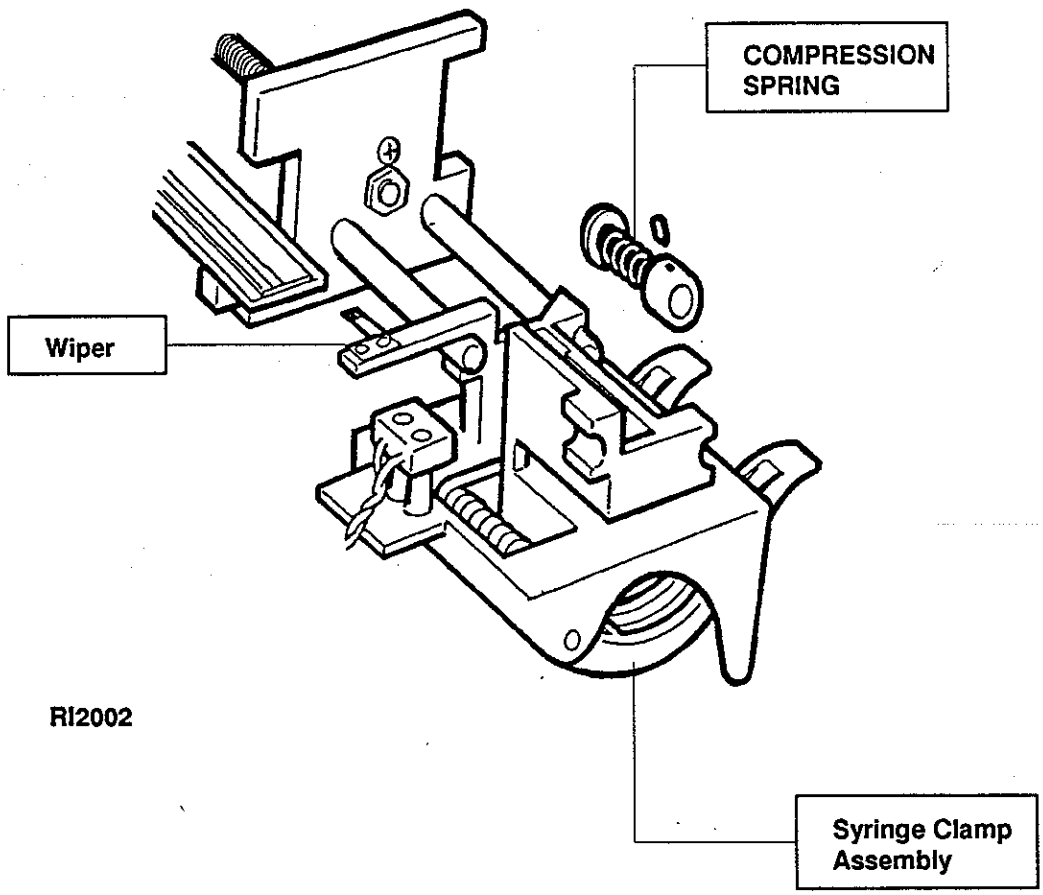
18 Test in accordance with inspection procedure in Section 2.

19 Attach a new instruction label* and replace batteries.

---

* *Order separately*

## Fig 6: Clamp Block



## Pusher Block Catalog N° 8851(Rate Infuser I Only)

### Materials:

1 Pusher block assembly
1 Wiper

### Procedure:

**1** Remove the instruction label from the back case. The label should be removed cleanly and completely in order to prepare the case for the replacement label that will be applied at the completion of this procedure. A heat gun is useful in removing the label. Remove batteries.

**2** With the pump lying on its front face, remove the three back case screws.

**3** *Remove the back case.*

**4** Remove the buzzer connector and the power connector .

**5** Remove the chassis by disconnecting the motor connector, the switch panels connectors, the optical switch connector, the clamp connector, and the resistor strip connector . Set the front case aside.

**6** Loosen the set screw on the clamp collar.

**7** Remove the collar, spring, and washer, along with the clamp.
*Set the clamp aside.*

**8** Loosen the two set screws that hold the bottom rod in place and remove the bottom rod..

**9** Remove the damaged pusher and discard.

**10** Hook the new pusher under the top rod. Replace the bottom rod and tighten the set screws..

**11** Replace the pusher wiper (facing the clamp direction). Attach the wiper by melting the plastic nibs located on the pusher. A flat-tipped soldering iron on a low setting is recommended. Care should be taken so as not to melt these nibs completely.

**12** Carefully slide the clamp ( being careful not to damage the clamp wiper ), the washer, the spring, and the collar (in that order) onto the rods. See Figure 8.

13 Position the clamp so that it is flush with the chassis end bracket and tighten the set screw located on the collar. Locate the collar to remove all spring looseness.

☐ **Caution: Do not compress the spring when tightening the set screw.**

14 Reinstall the chassis.

15 Reconnect the motor connector the switch panels connectors, the clamp connector , the switch panel connector , and the resistor strip connector .

16 The Alignment Test Procedure should be conducted at this point. See Section 5.

17 Reconnect the buzzer connector and the power connector.

18 Attach the back case while holding the battery door in its channel for positioning.

☐ **Caution: When reattaching the back case, take care not to bend or crimp the switch panel ribbon cables or any other wires.**

19 Test in accordance with inspection procedure in Section 2.

20 *Attach a new instruction label* and replace batteries.*

---

* Order separately

## Pusher block assembly: Catalog N°: 8837 (Rate Infuser II)

### Materials

1 Pusher block assembly
1 Wiper

### Procedure:

Utilize the procedure indicated for Catalog N° 8851

## Chassis assembly: Catalog N°: 8838 (Rate Infuser II only)

### Materials

Chassis assembly with motor, encoder gear, and optical switch.

### Procedure

Utilize the procedure indicated for Catalog N° 8885

## Clamp block assembly: Catalog N° 8836 ( Rate Infuser II only).

### Materials

1 Clamp block assembly
1 Clamp block wiper

### Procedure

Utilize the procedure indicated for Catalog N° 8894.

**Rear instruction label- Revision 0: Catalog N°8835 (Rate Infuser II only).**

## Materials

Instruction label

## Procedure:

Utilize the procedure indicated for Catalog N° 8893.

**EPROM-Revision 1: Catalog N° 8834 (Rate Infuser II only).**

## Materials

1 Program EPROM

## Procedure

Utilize the procedure indicated for Catalog N° 8888

**Front case assembly : Catalog N°8833 (Rate Infuser II only)**

## Materials

1 Front Case assembly
2 Curtains
1 Battery door with positive battery terminal
3 Case screw.

## Procedure

Utilize the procedure indicated for Catalog N° 8880

# NOTES

# SECTION 5

The test procedures detailed in this section should be performed on every opened unit to ensure the safety and efficacy of the Rate Infuser.

## ALIGNMENT TEST PROCEDURE

To align and test the Rate Infuser , you will need the following equipment:

Oscilloscope
Power supply, 5.5 +/-.050VDC,.
0 to 50 Amp Digital Voltmeter, 0 to 10.000 VDC range .001 volts resolution
0.365 inch spacer
4.0 lb. weight
See Figure 3 PC Board Layout for location of test points.

**Unit must be opened.**

## INITIAL SET UP

1. Determine that all connectors except the battery connector are correctly connected.
2. Connect a jumper between the collector and the emitter of Q2.
3. *Connect the power supply (in Off position) to connector J02 noting orientation.*
4. Turn the power supply on, adjust to 5.50 ± 0.05 Volts.

## HOME POSITION ALIGNMENT

1. *Place a .365 inch spacer between the lower bracket and the pusher. Advance the pusher until it rests* against the spacer.
2. Adjust power supply to 5.50 Volts ± .05Volts. Depress **POWER ON** switch.

3 Check voltage between (+) J08-1 and (-) J2-2 and record value.

4 Refer to the "Home Position Voltage Adjustment" table (following) and select Home Position Voltage value for the particular J08-1 voltage that was measured in the step above. This is the Home Position Voltage that the unit will be adjusting to during the next step.

5 Connect the voltmeter between U4-1 and J2-2 and adjust R14 until the reading at the digital Voltmeter is equal to the Home Position value selected in the table. Record reading.

6 ( EXAMPLE: For a voltage at J08-1 OF 3.00 VDC, R14 should be adjusted for a reading at U4-1 of 0.621 ± .003 VDC.)

## HOME POSITION VOLTAGE ADJUSTMENT TABLE

| J08-1 Voltage | Home Position Voltage |
|---|---|
| 2.91 | .602± 0.003 |
| 2.92 | .605 " |
| 2.93 | .607 " |
| 2.94 | .609 " |
| 2.95 | .611 " |
| 2.96 | .613 " |
| 2.97 | .615 " |
| 2.98 | .617 " |
| 2.99 | .619 " |
| 3.00 | .621 " |
| 3.01 | .623 " |
| 3.02 | .625 " |
| 3.03 | .627 " |
| 3.04 | .629 " |
| 3.05 | .631 " |
| 3.06 | .633 " |
| 3.07 | .635 " |
| 3.08 | .637 " |
| 3.09 | .640 " |
| 3.10 | .642 " |

## TACHOMETER ADJUSTMENT

1 Depress **POWER ON.**

2 Move pusher toward the top of the unit.

3 Place a syringe in the syringe clamp.

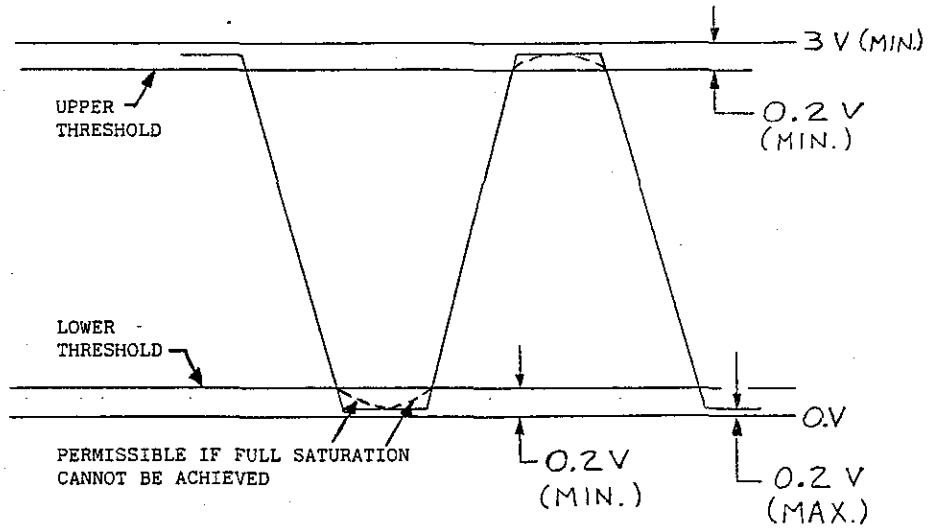
4 Depress **SYRINGE** switch. Depress **10** switch repeatedly.
When 05 cc BD appears on the upper LCD display, depress **SYRINGE** switch again;

5 Depress **RATE** switch. Program rate to **25.0 ml/hr.**
Depress **RATE** switch again;

6 Depress **INFUSE** switch.

## TACHOMETER CHEK (Cont.)

1 Using oscilloscope, measure waveform at U11-1 and another channel at R52. Adjust R51 for saturation ( waveform clipped top and bottom). Waveform should appear as follows:




2 Recheck waveform for saturation at 6.4 Volts ± 0.05 V and 4.4 Volts ± 0.05 V. Readjust R51 if necessary. Make sure threshold levels are as indicated above.

3 Record completion.

## OCCLUSION ADJUSTMENT

1 With the unit open and the clamp lubricated, measure the voltage between (+) J8-4 (or U4 - Pin 5) and (-) J2-2 with the voltmeter and record value.

2 Multiply the reading by 6 and record value.

3 Adjust R17 for the voltage between (+) U4-7 and (-) J2-2 to be equal to the value calculated in the step above , -0, +.020 VDC. Record actual value.

4 Check again the voltage at J8-4 and hang a 4.0 pound weight to the unit clamp. Change in voltage at J8-4 should be between .010 and .015 VDC

5 Release the weight and voltage at J8-4 should return to the original value ± .001 VDC.

6 Repeat two steps above three times. Readings should repeat within ± .001 VDC. Record value.

6 **Repeat two steps above three times. Readings should repeat within ± .001 VDC. Record value.**

7 Twist clamp on rods to the limits of its free play. Reading at J08-4 should not change by more than .002 volts DC.

8 Test occlusion with 60 cc BD Syringe at 99 ml/hr.
Minimum pressure is 7.0 psi, maximum is 12.0 psi. Repeat adjustments above if out of range.

9 Depress the **POWER OFF** switch. Record completion.

## SAFETY CHECKS

### RESISTOR STRIP CHECK ( Reset Power Supply to 5.50 V ± .05 V)

1 With unit infusing (green "INFUSE" LED flashing) short J8-1/D8 cathode to J8-2.

2 Alarm tone and ATTENTION LED should be activated within 5 seconds and until will stop infusing.

3 Depress **POWER OFF** and remove short.

4 Record completion.

### Q4 TRANSISTOR CHECK

1 Short J2-1 to Q4-C/C11 junction. Turn power **ON**. Set any rate and syringe size.

2 *Depress* ***INFUSE.***

3 Alarm tone and ATTENTION LED should be activated after several seconds and until will display **"EE".**

4 Depress **POWER OFF** and remove short.

### RUN-AWAY TEST

1 Turn power **ON**. Short J2-1 to J3-1.

2 Alarm tone and ATTENTION LED should be activated within 5 seconds and unit will display **"EE"**

3 Depress **POWER OFF** and remove short.

4 *Record completion.*

# NOTES

# For technical service, please contact:


## BECTON DICKINSON

## 2 Bridgewater Lane

## Lincoln Park NJ 07035

## 1-800-BECTON 6

## 201-633-5500